IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	MITANI et al.	Docket No.:	10873.828USWO
Serial No.:	10/030,235	Filed:	October 29, 2001
Int'l Appln No.:	PCT/JP01/01475	Int'l Filing Date:	February 27, 2001
Title:	CONDUCTIVE ADHESIVE AND PACKAGE OF ELELCTRONIC ELEMENT, AND METHOD OF PACKING		

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service, as first class mail, with sufficient postage, in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on March 18, 2002.
By: _____
Name: Todd Michel

PRELIMINARY AMENDMENT

Box PCT
Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please enter the following preliminary amendment (marked-up copy attached), which is based on the Article 19 amendments, based on claims amended in prosecution of the international application and published in the International Preliminary Examination Report:

IN THE SPECIFICATION

Please replace the paragraph, begininng on page 4, line 8, with the following:

The present invention provides a method of electrically connecting a circuit substrate electrode and an electronic element electrode through a conductive adhesive containing a conductive filler and a binder resin, wherein an average content of the conductive filler is in a range from 20 wt% to 70 wt%. The process comprises steps of: applying the adhesive to a gap between the circuit

substrate electrode and the electronic element electrode; applying pressure ranging from 0.01 MPa to 50 MPa to the circuit substrate electrode and the electronic element electrode; squeezing the adhesive containing less conductive filler so as to make the content of the conductive filler in the adhesive present in the gap between the electrodes higher than the average content.

Please delete the following paragraph, beginning on page 5, line 14:

FIG. 14 is a cross-sectional view of a package of an electronic element in Examples 1-3 of the present invention.

Please replace the paragraph, beginning on page 9, line 23, with the following:

FIG. 3C is an enlarged schematic view to show a connection interface between the element electrode 2 and the conductive adhesive 3. Numeral 2a denotes an electrically resistant layer comprising a surface oxide layer or the like formed on a surface of the element electrode 2. The conductive adhesive 3 comprises a conductive filler 3c and a resin 3d, both of which are shown separately. On this connection interface, the electrically resistant layer 2a is either eliminated or broken so that at least one part of the conductive filler 3c is contacted with a metal of the element electrode 2, diffusion layers of the components are formed, or the conductive filler 3c is fused with the element electrode 2. Thereby, the metal composing the electrode is contacted or connected to a metal composing the conductive filler 3c so as to decrease connection resistance, and generation and growth of an oxide layer on the

connection interface can be suppressed. Such a structure is useful especially in preventing problems from occurring at the connection interface when the electronic element or the electrode of the circuit substrate has a surface of a metal selected from the group consisting of metals susceptible to oxidation, e.g., solder and tin.

Please replace the paragraph, beginning on page 11, line 10, with the following:

A pressure range effective for suppressing variation in the connection resistance is from 10 KPa to 50 MPa, or preferably, from 20 KPa to 20 MPa. When the applied pressure is less than 10 KPa, the spacing between the element electrode 12 and the substrate electrode 14 becomes greater than 20 times the maximum dimension (D max) of the biggest conductive filler, which will provide insufficient effect in breaking surface oxide layers of the electrodes. When the pressure exceeds 50 MPa, the electronic element 1is subject to excessive pressure, which may result in malfunction or failure.

Please replace the paragraph, beginning on page 17, line 30, with the following:

The following examples refer to packages of electronic elements formed by using a conductive adhesive according to the present invention. FIG. 3A shows a package comprising a circuit substrate 5 having a substrate electrode 4 on which a conductive adhesive 3 is formed, and further an electronic element 1 is mounted thereon. The circuit substrate 5 is a FR-4 glass epoxy resin substrate having a thickness of 0.6 mm (FR-4 denotes a standard of glass epoxy resin

substrate). The substrate electrode 4 is prepared by plating Ni of about 1 μm thickness on a surface of a copper foil having a thickness of about 12 μm, and further flash-plating gold on the Ni surface. The electronic element was a 3216-sized jumper chip resistor.

IN THE CLAIMS

Please amend the following claim, found on page 28 of §19 amendment sheet:

1. (Twice Amended) A conductive adhesive comprising a conductive filler and a binder resin in order to connect electrically a circuit substrate electrode to an electronic element electrode, wherein

an average content of the conductive filler is in a range from 20 wt% to 70 wt%; and

the conductive filler is a mixture of 30-99 wt% of a metal filler having protrusions and 1-70 wt% of at least one filler having a shape selected from the group consisting of a scale, a flake and a particle.

IN THE DRAWINGS

Please delete Figure 14.

REMARKS

The above preliminary amendment is made to make minor editorial corrections to the specification and claims.

Applicants respectfully request that the preliminary amendment described herein be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above-identified application.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney-of record, Douglas P. Mueller (Reg. No. 30,300), at (612) 371.5237.

Respectfully submitted,

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Dated: March 18, 2002

By______________________
Douglas P. Mueller
Reg. No. 30,300

DPM/tvm

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IN THE SPECIFICATION

Please amend the following paragraph, beginning on page 4, line 8:

The present invention provides a method of electrically connecting a circuit substrate electrode and an electronic element electrode through a conductive adhesive containing a conductive filler and a binder resin, wherein an average content of the conductive filler is in a range from 20 wt% to 70 wt%. The process comprises steps of: applying the adhesive to a gap between the circuit substrate electrode and the electronic element electrode; applying pressure ranging from 0.01 MPa to 50 MPa to the circuit substrate electrode and the electronic element electrode; squeezing the adhesive [containing less conductive filler] so as to make the content of the conductive filler in the adhesive present in the gap between the electrodes higher than the average content.

Please delete the following paragraph, beginning on page 5, line 14:

[FIG. 14 is a cross-sectional view of a package of an electronic element in Examples 1-3 of the present invention.]

Please amend the following paragraph, beginning on page 9, line 23:

FIG. 3C is an enlarged schematic view to show a connection interface between the element electrode 2 and the conductive adhesive 3. Numeral 2a denotes an electrically resistant layer comprising a surface oxide layer or the like formed on a surface of the element electrode 2. The conductive adhesive 3 comprises a conductive filler 3c and a resin 3d, both of which are shown separately. On this connection interface, the electrically resistant layer 2a is either eliminated or broken so that at least one part of the conductive filler 3c is contacted

with a metal of the element electrode 2, diffusion layers of the components are formed, or the conductive filler 3c is fused with the element electrode 2. Thereby, the metal composing the electrode is contacted or connected to a metal composing the conductive filler 3c so as to decrease connection resistance, and generation and growth of an oxide layer on the connection interface can be suppressed. Such a structure is useful especially in preventing problems from occurring at the connection interface when the electronic element or the electrode of the circuit substrate has a surface of a metal selected from the group consisting of [gold, silver, palladium, and an alloy thereof, or a mixture of metals. That is, it is effective especially for a structure composing] metals susceptible to oxidation, e.g., solder and tin.

Please amend the following paragraph, beginning on page 11, line 10:

A pressure range effective for suppressing variation in the connection resistance is from 10 KPa to 50 MPa, or preferably, from 20 KPa to 20 MPa. When the applied pressure is less than 10 KPa, the spacing between the element electrode 12 and the substrate electrode 14 becomes greater than 20 times the maximum dimension (D max) of the biggest conductive filler, which will provide insufficient effect in breaking surface oxide layers of the electrodes. When the pressure exceeds 50 MPa, the electronic element [11] 1 is subject to excessive pressure, which may result in malfunction or failure.

Please amend the following paragraph, beginning on page 17, line 30:

The following examples refer to packages of electronic elements formed by using a conductive adhesive according to the present invention. FIG. [14] 3A shows a package comprising a circuit substrate [51] 5 having a substrate electrode [52] 4 on which a conductive adhesive [53] 3 is formed, and further an electronic element [54] 1 is mounted thereon. The

circuit substrate [51] 5 is a FR-4 glass epoxy resin substrate having a thickness of 0.6 mm (FR-4 denotes a standard of glass epoxy resin substrate). The substrate electrode [52] 4 is prepared by plating Ni of about 1 μm thickness on a surface of a copper foil having a thickness of about 12 μm, and further flash-plating gold on the Ni surface. The electronic element was a 3216-sized jumper chip resistor.

IN THE CLAIMS

Please amend the following claim, found on page 28 of §19 amendment sheet:

1. (Twice Amended) A conductive adhesive comprising a conductive filler and a binder resin in order to connect electrically a circuit substrate electrode to an electronic element electrode, wherein

an average content of the conductive filler is in a range from 20 wt% to 70 wt%; and

the conductive filler is a mixture of 30-99 wt% of a metal filler having protrusions and 1-70 wt% of at least one filler having a shape selected from the group consisting of a scale, a flake and a particle[; and

the content of the conductive filler is higher than the average content for the adhesive present in a gap between the electrodes during packaging of the circuit substrate electrode and the electronic element electrode by interposing the conductive adhesive, and the content of the conductive filler becomes lower than the average content for the adhesive squeezed out of the gap].

CLAIMS

Amendment 19

1. (Amended) A conductive adhesive con
a binder resin in order to connect electrically a
an electronic element electrode, wherein

an average content of the conductive filler is in a range from 20 wt% to 70 wt%;

the conductive filler is a mixture of 30-99 wt% of a metal filler having protrusions and 1-70 wt% of at least one filler having a shape selected from the group consisting of a scale, a flake and a particle; and

the content of the conductive filler is higher than the average content for the adhesive present in a gap between the electrodes during packaging of the circuit substrate electrode and the electronic element electrode by interposing the conductive adhesive, and the content of the conductive filler becomes lower than the average content for the adhesive squeezed out of the gap.

2. (Cancelled)

3. The conductive adhesive according to claim 1, wherein the conductive filler having protrusions is a dendrite filler.

4. (Cancelled)

5. The conductive adhesive according to claim 1, wherein the content of the conductive filler is in a range from 30 wt% to 50 wt%.

6. The conductive adhesive according to claim 1, wherein the conductive filler is at least one metal selected from the group consisting of copper, silver, gold, platinum, palladium, nickel, stainless steel and an alloy thereof.

7. (Amended) The conductive adhesive according to claim 1, wherein the conductive filler is prepared by coating a metal with at least one substance selected from the group consisting of silver, gold and palladium.

8. The conductive adhesive according to claim 1, wherein the conductive filler has an average particle diameter ranging from 1 μm to 100 μm.

9. The conductive adhesive according to claim 1, wherein the binder resin is an elastic adhesive resin.

10. A package of an electronic element provided by electrically connecting a circuit substrate electrode to an electronic element electrode by means of a conductive adhesive containing main components of a conductive filler and a binder resin, wherein

an average content of the conductive filler is in a range from 20 wt% to 70 wt%,

the conductive filler is a mixture of 30-99 wt% of a metal filler having protrusions and 1-70 wt% of at least one filler having a shape selected from the group consisting of a scale, a flake and a particle, and

the content of the conductive filler is higher than the average content for the adhesive present in a gap between the electrodes during packaging of the circuit substrate electrode and the electronic element electrode by interposing the conductive adhesive, and the content of the conductive filler becomes lower than the average content for the adhesive squeezed out of the gap.

11. (Cancelled)

12. (Amended) The package of an electronic element according to claim 10, wherein the conductive filler having protrusions is a dendrite filler.

13. (Cancelled)

14. The package of an electronic element according to claim 10, wherein the content of the conductive filler is in a range from 30 wt% to 50 wt%.

15. The package of an electronic element according to claim 10, wherein the conductive filler is at least one metal selected from the group consisting of copper, silver, gold, platinum, palladium, nickel, stainless steel and an alloy thereof.

16. (Amended) The package of an electronic element according to claim 10, wherein the conductive filler is prepared by coating a metal with at least one substance selected from the group consisting of silver, gold and palladium.

17. The package of an electronic element according to claim 10, wherein the conductive filler has an average particle diameter ranging from 1 μm to 100 μm.

18. The package of an electronic element according to claim 10, wherein the binder resin is an elastic adhesive resin.

19. The package of an electronic element according to claim 10, wherein the content of the conductive filler is in a range from 75 wt% to 95 wt% for the adhesive in a gap between the circuit substrate electrode and the electronic element electrode.

20. (Amended) The package of an electronic element according to claim 10, wherein the circuit substrate electrode and the electronic element electrode are connected to each other by being scratched partially on the surfaces by the metal filler having protrusions.

21. The package of an electronic element according to claim 10, wherein the spacing between the element electrode and the substrate electrode is at least 1.1 times a minimum dimension (D min) of a smallest conductive filler contained in the conductive resin, and at most 20 times a maximum dimension (D max) of a biggest conductive filler contained in the conductive resin.

22. (Amended) A packaging method comprising connecting electrically a circuit substrate electrode to an electronic element electrode by means of a conductive adhesive comprising a conductive filler and a binder resin as main components, wherein

an average content of the conductive filler is in a range from 20 wt% to 70 wt%;

the conductive filler is a mixture of 30-99 wt% of a metal filler having protrusions and 1-70 wt% of at least one filler having a shape selected from the group consisting of a scale, a flake and a particle and the circuit substrate is connected to the electronic element electrode by:

applying the adhesive to a gap between the circuit substrate electrode and the electronic element electrode;

applying the circuit substrate electrode and the electronic element electrode with pressure ranging from 0.01 MPa to 50 MPa; and

squeezing out the adhesive from the gap between the electrodes so that the adhesive remaining in the gap contains the conductive filler with a higher content than the average content.

23. (Cancelled)

24. (Amended) The packaging method according to claim 22, wherein the conductive filler having protrusions is a dendrite filler.

25. (Cancelled)

26. The packaging method according to claim 22, wherein the content of the conductive filler is in a range from 30 wt% to 50 wt%.

27. The packaging method according to claim 22, wherein the conductive filler is at least one metal selected from the group consisting of copper, silver, gold, platinum, palladium, nickel, stainless steel and an alloy thereof.

28. (Amended) The packaging method according to claim 22, wherein the conductive filler is prepared by coating a metal with at least one substance selected from the group consisting of silver, gold and palladium.

29. The packaging method according to claim 22, wherein the conductive filler has an average particle diameter ranging from 1 μm to 100 μm.

30. The packaging method according to claim 22, wherein the binder resin is an elastic adhesive resin.

31. The packaging method according to claim 22, wherein the content of the conductive filler is in a range from 75 wt% to 95 wt% for the adhesive in a gap between the circuit substrate electrode and the electronic element electrode.

32. (Amended) The packaging method according to claim 22, wherein the circuit substrate electrode and the electronic element electrode are connected to each other by being scratched partially on the surfaces by the metal filler having protrusions.

33. The packaging method according to claim 22, wherein the spacing between the element electrode and the substrate electrode is at least 1.1 times a minimum dimension (D min) of a smallest conductive filler contained in the conductive resin, and at most 20 times a maximum dimension (D max) of a biggest conductive filler contained in the conductive resin.

Description based on the provision of PCT 19(1)

(1) Claim 1 of the present invention is combined with original claims 2, 4, and 10 in order to distinguish the claimed invention from the inventions described in the respective references.

(2) The independent claims 10 and 22 are amended as well to be consistent with the claim 1.

(3) The distinguished structure provides the excellent effect described in page 32, lines 9-12 (from p.26, line 19 to p.27, line 4 in translation) of the specification "When the adhesive according to the present invention is compressed, the resin component squeezes out while the conductive filler component remains inside so as to raise the concentration of the conductive filler. This raises the concentration of the conductive filler and provides connection by scratching the electrode surface. As a result, the conductive adhesive can be provided onto the substrate electrode of the circuit substrate without using any solder, and an electronic element can be packaged.".